CLAIMS

What is claimed is:

1. A measurement-while-drilling (MWD) apparatus conveyed within a borehole for determining electrical properties of a formation surrounding said borehole, said MWD device comprising:
   (a) a rotatable drill collar;
   (b) at least one stabilizer coupled to said collar and rotating at the same speed as said drill collar;
   (c) a hardfacing on outer face of said at least one stabilizer to maintain a desired standoff from the borehole wall;
   (d) at least one transmitter on the at least one stabilizer for conveying of at least one RF signal into said formation; and
   (e) at least one receiver on the at least one stabilizer, said at least one transmitter and said at least one receiver, for obtaining a resistivity image of the earth formation from a signal received at the at least one receiver resulting from interaction of the at least one RF signal with said formation..

2. The method of claim 1 wherein the at least one transmitter and the at least one receiver comprise a plurality of transmitter-receiver distances.

3. The apparatus of claim 1, wherein said at least one stabilizer is extendable.

4. The apparatus of claim 1, wherein said at least one transmitter further comprises two spaced-apart collimated transmitting antennae.

5. The apparatus of claim 4, wherein said at least one receiver further comprises two spaced-apart collimated receiving antennae evenly positioned between said at least two transmitting antennae.

6. The apparatus of claim 1, wherein said at least one transmitter and said at least one receiver are operated substantially within a frequency range of 10 MHz to 2 GHz

7. The apparatus of claim 1 further comprising an analog to digital (A/D) converter for undersampling of said at least one received signal.

8. The apparatus of claim 1, further comprising at least one of: i) an axial accelerometer, or ii) a second resistivity sensor at a different axial position, for determining a rate of penetration of said drill collar.

9. The apparatus of claim 1, further comprising at least one transmitter and at least one receiver on an additional stabilizer.

10. The apparatus of claim 1, wherein said at least one receiver and said at least one transmitter are disposed within at least one cavity along the outer face of said at least one stabilizer, said at least one cavity having a rectangular slot.

11. The apparatus of claim 10, wherein a long side of said rectangular slot is parallel to the direction of a magnetic dipole moment of one of: i) the transmitter, and, ii) the receiver disposed within said cavity.

12. The apparatus of claim 11, wherein a magnetic dipole moment of the at least one transmitter and the at least one receiver are aligned parallel to a longitudinal axis of the drill collar.

13. The apparatus of claim11, wherein a magnetic dipole moment of the at least one transmitter and the at least one receiver are aligned perpendicular to a longitudinal axis of the drill collar.

14. The apparatus of claim 11, wherein a magnetic dipole moment of the at least one transmitter is aligned substantially orthogonal to a dipole moment of the at least one receiver

15. A method of determining electrical properties of a formation surrounding a borehole, comprising:

(a) conveying a logging tool having a rotatable drill collar into a borehole;

(b) using at least one transmitter positioned on at least one stabilizer coupled to said rotatable drill collar to inject at least one RF signal into said formation;

(c) using at least one receiver positioned on said at least one stabilizer for making a measurement of at least one of (I) a phase, and, (II) an attenuation, of said RF signal upon propagation through said formation,; and

(d) using a hardfacing on outer face of said extendable stabilizer to maintain a desired standoff from the borehole wall.

16. The method of claim 15 wherein said at least one transmitter and said at least one receiver define a plurality of transmitter-receiver spacings.

17. The method of claim 15, wherein said at least one stabilizer is extendable.

18. The method of claim 15, wherein using said at least one transmitter further comprises using two spaced-apart collimated transmitting antennae.

19. The method of claim 15, wherein said at least one receiver further comprises two spaced-apart collimated receiving antennae evenly positioned between said at least two transmitting antennae.

20. The method of claim 15, wherein using said at least one transmitter and said at least one receiver further comprises operating said at least one transmitter and said at least one receiver substantially within a frequency range of 10 MHz to 2 GHz.

21. The apparatus of claim 15, further comprising determining a rate of penetration of said drill collar using one of: i) an axial accelerometer, or ii) a second resistivity sensor at a different axial position.

22. The method of claim 15, further comprising at least one transmitter and at least one receiver on an additional stabilizer.

23. The method of claim 15, wherein said at least one receiver and said at least one transmitter are disposed within at least one cavity along the outer face of said at least one stabilizer, said at least one cavity having a rectangular slot.

24. The method of claim 23, wherein a long side of said rectangular slot is parallel to the direction of a magnetic dipole moment of one of: i) the transmitter, and, ii) the receiver disposed within said cavity.

25. The method of claim 23, wherein a magnetic dipole moment of the at least one transmitter and the at least one receiver are aligned parallel to a longitudinal axis of the drill collar.

26. The method of claim 23, wherein a magnetic dipole moment of the at least one transmitter and the at least one receiver are aligned substantially parallel to each other

27. The method of claim 23, wherein a magnetic dipole moment of the at least one transmitter is aligned substantially orthogonal to a dipole moment of the at least one receiver.

28. The method of claim 15 further comprising undersampling said propagated RF signal.

29. The method of claim 15 further comprising determining from said at least one measurement at least one of (i) a resistivity of said formation, (ii) a resistivity of a connate formation fluid, (iii) a dielectric constant of a dry rock matrix, and, (iv) a water filled porosity of the formation.

30. The method of claim 15 further comprising repeating step (c) at a plurality of angular positions of said logging tool and at a plurality of depths of said logging tool in the borehole, providing a plurality of measurements.

31. The method of claim 30 further comprising determining from said plurality of measurements a resistivity image of a wall of said borehole.

32. The method of claim 30 further comprising using a downhole processor for determining from said plurality of measurements an apparent dip of a bed boundary.

33. The method of claim 30 further comprising using a downhole orientation sensor for measuring said angular positions.

34. The method of claim 30 further comprising determining said plurality of depths at least in part from downhole accelerometer measurements.

35. The method of claim 32 further comprising determining said plurality of depths at least in part from downhole measurements.

36. The method of claim 35 further comprising telemetering said apparent dip and said downhole depth measurements to an uphole location.

37. The method of claim 36 further comprising:

(i) comparing said telemetered downhole depth measurements with depth measurements made at a surface location, and

(ii) using a processor for correcting said apparent dip based on said comparison.